Administratively Confidential

NOAA Scientific Publications Report
May 25- June 7, 2012

Contents

1. HIGHLIGHTED ARTICLES

1a. **Title:** *Increase in observed net CO2 uptake by land and oceans during the last 50 years*
Journal: Nature
Authors: Ashley Ballantyne (University of Colorado), **Caroline Alden** (CIRES/NOAA), **John Miller** (CIRES/NOAA), **Pieter Tans** (NOAA/ESRL), and James White (University of Colorado)
Publication Date: Estimated June 2012
Summary: One of the greatest sources of uncertainty for future climate predictions is the response of the global carbon cycle to climate change. Although approximately one half of total carbon dioxide (CO_2) emissions are currently taken up by combined land and ocean carbon reservoirs, models predict a decline in future carbon "sinks" resulting in a positive carbon-climate feedback. Findings from this study indicate that the Earth's oceans, forests and other ecosystems continue to soak up about half the CO_2 emitted into the atmosphere by human activities, even as those emissions have increased. The team analyzed 50 years of global CO_2 measurements and emissions inventories and found that the processes by which the planet's oceans and ecosystems absorb the greenhouse gas are not yet saturated. In fact, as human emissions of CO_2 have grown, natural "sinks" of the gas have roughly kept pace.
Press Release: In clearance (to OAR 22 May)
Rollout Plan: NOAA press release, possibly joint with the University of Colorado and CIRES, but TBD. The Climate.gov team is also aware.

1b. **Title**: *Decadal changes in the aragonite and calcite saturation state of the Pacific Oceans*
Journal: Global Biogeochemical Changes
Authors: **Richard Feely** (PMEL), **Christopher Sabine** (PMEL), Robert Byrne (Univ South Florida), Frank Millero (Univ Miami), Andrew G. Dickson (Scripps), **Rik Wanninkhof (AOML),** Akihito Murata (Japan Agency for Marine-Earth Science and Technology), Lisa Miller (Fisheries and Oceans Canada), **Dana Greeley** (PMEL)
Publication Date: Online no
http://www.agu.org/journals/pip/gb/2011GB004157-pip.pdf
Summary: Based on measurements from the global carbon dioxide CLIVAR/CO2 Repeat Hydrography Program and Canadian P Line survey, researchers observe a fairly uniform decrease in the aragonite and calcite saturation state in the western and eastern Pacific Ocean. The saturation state affects the ability of some marine creatures to make their shells or, in the case of corals, structural skeletons. The change is caused by the ocean's absorption of excess carbon dioxide in the atmosphere.
Important Conclusions:

- Since the start of the Industrial Revolution there has been a decrease of about 16 percent in aragonite and calcite saturation state in the Pacific Ocean.
- While the decrease is fairly uniform in the western and eastern Pacific, there were slower rates of change measured in the north and south.
- If CO_2 emissions continue as projected out to the end of the century, many coral reefs in the Pacific would probably no longer be able to sustain their vitality.

Rollout Plan: NOAA theme story possible

1c. **Title:** *How well can we measure the vertical wind speed? Implications for fluxes of energy and mass*
Journal: Boundary Layer Meteorology
Authors and affiliations: John Kochendorfer (OAR/ARL), **Tilden P. Meyers** (OAR/ARL), John Frank, William Massman, and **Mark W. Heuer** (OAR/ARL)
Expected Publication Date: July 2012
Abstract: Field measurements of the exchange of water, energy, and greenhouse gasses between the surface of the earth and the atmosphere help us understand the earth's energy budget. These field measurements are also used to research the relationship between the earth's climate and ecosystems. Using a new technique, the accuracy of traditional field methods used to measure the surface-atmosphere exchange was evaluated.
Important Conclusions:

- An error of 10-15% in the measured surface-atmosphere exchange of water, energy, and greenhouse gasses has been discovered.
- The lack of energy budget closure that has plagued ecosystem and micrometeorological field studies for the last 20-30 years is explained.
- Simple methods available to correct past measurements and guidance on how to avoid future errors by redesigning the wind velocity sensor are offered.

2. ADDITIONAL ARTICLES

Top Tier Journals

None

Intermediate-Tier Journals

2a. **Title:** *Social and behavioural factors in cetacean responses to over-exploitation: Are odontocetes less 'resilient' than mysticetes?*
Journal: Journal of Marine Biology
Authors and affiliations: Paul R. Wade (NMFS - AFSC), Randall R. Reeves, and **Sarah L. Mesnick (NMFS - SWFSC)**

Expected publication date: Unknown; accepted April 26, 2012
Abstract: Many severely depleted populations of baleen whales (Mysticeti) have exhibited clear signs of recovery from exploitation whereas there are few examples of recovery of severely depleted populations of toothed cetaceans, or odontocetes (Odontoceti). The hypothesis developed in the present article is that odontocetes are less resilient to intensive exploitation than mysticetes and that this difference is due, at least in part, to social and behavioural factors. Clearly, a part of the lack of resilience to exploitation stems from the life history of odontocetes, particularly their relatively old ages at first reproduction and low calving rates. However, an additional factor that may contribute to this lack of resilience is that odontocetes exhibit a diverse array of social systems, ranging from the relatively hierarchical and stable pattern of killer whales and sperm whales, to the classic fission-fusion pattern of many dolphins. In at least some odontocetes, survival and reproductive success may depend on such things as: (a) social cohesion and social organization, (b) mutual aid in defence against predators and possible alloparental care such as 'babysitting' and communal nursing, (c) sufficient opportunities for transfer of 'knowledge' (learned behaviour) from one generation to the next, and (d) leadership by older individuals that know where and when to find scarce prey resources and how to avoid high-risk circumstances (e.g. ice-entrapment, stranding, predation). We found little evidence of strong recovery in any of the depleted populations examined, even when decades had passed since the phase of intense exploitation ended. Their relatively low population potential rates of increase mean that odontocete populations can be over-exploited with take rates of only a few percent per year. In several species of highly social odontocetes, there is evidence that exploitation could have effects beyond the simple dynamics of individual removals. Four species showed evidence of a decrease in birth rates following exploitation, from mechanisms hypothesized to include a deficit of adult females, a deficit of adult males, and disruption of mating systems involving dominance by a few individuals. The evidence for a lack of strong recovery by many heavily exploited odontocete populations indicates that future management of exploitation should be more precautionary.
Important conclusions:

- Odontocetes are not as resilient to exploitation as mysticetes, as few populations have shown recovery.
- This is partly explained by their life history, but also may be due to consequences of their social structure and behavior.

Regional/Highly Specialized Journals

2a. **Title:** *Diets and trophic linkages of epipelagic fish predators in coastal Southeast Alaska during a period of warm and cold climate years, 1997-2011*
Journal: Marine and Coastal Fisheries
Authors and affiliations: Sturdevant, M. V., J. A. Orsi, and E. A. Fergusson (*NMFS Alaska Fisheries Science Center*)
Expected Publication Date: Summer 2012
Abstract: This study identifies important trophic links for epipelagic marine fish

predators in Southeast Alaska (SEAK) to improve understanding of marine ecosystem dynamics in response to climate change. We examined fish predators from surveys conducted by the Southeast Coastal Monitoring (SECM) project of Auke Bay Laboratories in the marine waters of SEAK from May to September, 1997-2011. SECM research has emphasized longterm monitoring of strait and coastal marine habitats used by juvenile salmon (*Oncorhynchus spp*.) and associated epipelagic fishes to understand how environmental variation affects sustainability of salmon resources. This study describes the degree of piscivory, incidence of juvenile salmon prey, and frequency and weight composition of prey in the diets of epipelagic fish predators, but did not clearly detect an effect of warm-versus-cold climate years on diets of key planktivorous or piscivorous predators over the 15-year time series.

Important Conclusions:

- We detected no effect of warm-versus-cold climate years on diets of key planktivorous or piscivorous predators over the 15-year time series.
- Identifying the persistence of trophic links in epipelagic waters over time is important because climate-related changes in the upper water column have the potential to impact SEAK marine ecosystem dynamics and the productivity of important regional fisheries by altering key prey resources and trophic interactions.

2b. Title: *Exploring Impacts of Rapid-scan Radar Data on NWS Warning Decisions*

Journal: Weather and Forecasting

Authors: Pamela L. Heinselman (National Severe Storms Laboratory), Daphne S. LaDue, **Heather Lazrus** (Cooperative Institute for Mesoscale Meteorological Studies)

Expected publication date: Early online release (4/19/12)

Significance: To explore potential impacts of rapid-scan weather radar data on forecaster warning decision-making, twelve National Weather Service forecasters participated in a preliminary study involving a tropical tornadic supercell case. Their decision processes were observed and audio recorded; interactions with data displays were video recorded; the products were archived; and debriefings were conducted. Analysis of these data revealed that though teams examining the same data sometimes came to different conclusions about whether and when to warn, the resulting warning decisions were suggestive of a positive effect of rapid-scan data on warning lead time for short-lived, weak tornadoes, demonstrating the potential to extend warning lead time and improve forecasters' confidence compared to standard operations.

2c. Title: *Ciguatoxicity in the main Hawaiian Islands: spatial and temporal variability in the introduced reef carnivore* Cephalopholis argus

Journal: Journal of Research in Environmental Science and Toxicology

Authors and affiliations: Paul Bienfang University of Hawai'i at Manoa, HI; S. DeFelice , Louisiana State University, LA; E. Laws, Hawai'i at Manoa, HI;

Patrick C. Caldwell, National Coastal Data Development Center, NOAA/NESDIS/NODC
Expected Publication Date: April 2012
Abstract: Decades following its introduction, the peacock grouper (Cephalopholis argus) developed a reputation for causing ciguatera fish poisonings in Hawaii. This study examined the frequency of ciguatoxicity in this carnivorous reef species, and the nature of variability in ciguatoxicity associated with season, location (i.e., island: island, leeward: windward), temperature, and specimen size. These ciguatoxicity-size data refute the popular expectation that the smaller specimens should be safe to eat. We conclude that seasonal and/or spatial differences in temperature are of insufficient magnitude to elicit a perceptible change in the propensity for ciguatoxic fish in the Main Hawaiian Islands such as has been observed in Caribbean and South Pacific localities.
Important Conclusions:

- Seasonal and/or spatial differences in temperature are of insufficient magnitude to elicit a perceptible change in the propensity for ciguatoxic fish in the Main Hawaiian Islands such as has been observed in Caribbean and South Pacific localities.
- The examination of ciguatoxicity in this local provides insights on the relative roles of individual factors (e.g., temperature, leeward/windward location, fish size, season) on the prevalence of ciguatera in the carnivorous fish populations.

2d. **Title:** *Temperature versus salinity gradients below the ocean mixed layer*
Journal: Journal of Geophysical Research: Oceans
Authors and affiliations: Helber, Robert W., A. Birol Kara, James G. Richman, Michael R. Carnes, Charlie N. Barron, Harley E. Hurlburt, and **Timothy Boyer (**Ocean Climate Lab/NODC/NESDIS)
Expected Publication Date: May 3, 2012
Abstract: We characterize the global ocean seasonal variability of the temperature versus salinity gradients in the transition layer just below the mixed layer using observations of conductivity temperature and depth and profiling float data from the National Ocean Data Center's World Ocean Data set. The balance of these gradients determines the temperature versus salinity control at the mixed layer depth (MLD). We define the MLD as the shallowest of the isothermal, isohaline, and isopycnal layer depths (ITLD, IHLD, and IPLD), each with a shared dependence on a 0.2_C temperature offset. Data are gridded monthly using a variational technique that minimizes the squared analysis slope and data misfit. Surface layers of vertically uniform temperature, salinity, and density have substantially different characteristics. By examining differences between IPLD, ITLD, and IHLD, we determine the annual evolution of temperature or salinity or both temperature and salinity vertical gradients responsible for the observed MLD.
Important Conclusions:

- We find ITLD determines MLD for 63% and IHLD for 14% of the global ocean. The remaining 23% of the ocean has both ITLD and IHLD nearly

identical. It is found that temperature tends to control MLD where surface heat fluxes are large and precipitation is small. Conversely, salinity controls MLD where precipitation is large and surface heat fluxes are small. In the tropical ocean, salinity controls MLD where surface heat fluxes can be moderate but precipitation is very large and dominant.

- Mixed layer depth is an important indicator for upper ocean physical/chemical/biological processes. Any insight into the nature of this feature can help in the understanding of these processes.

2e. **Title:** *Modeling geologically abrupt climate changes in the Miocene: Potential effects of high-latitudinal salinity changes*
Journal: Natural Science
Published: March 26, 2012
Authors: Bernd J. Haupt**, Dan Seidov** NOAA/NESDIS/NODC)
Abstract from paper: The cooling of the Cenozoic, including the Miocene epoch, was punctuated by many geologically abrupt warming and cooling episodes— strong deviations from the cooling trend with time span of ten to hundred thousands of years. Our working hypothesis is that some of those warming episodes at least partially might have been caused by dynamics of the Antarctic Ice Sheet, which, in turn, might have caused strong changes of sea surface salinity in the Miocene Southern Ocean. Feasibility of this hypothesis is explored in a series of offline-coupled ocean-atmosphere computer experiments. The results suggest that relatively small and geologically short-lived changes in freshwater balance in the Southern Ocean could have significantly contributed to at least two prominent warming episodes in the Miocene. Importantly, the scenario- based experiments also suggest that the Southern Ocean was more sensitive to the salinity changes in the Miocene than today, which can attributed to the opening of the Central American Isthmus as a major difference between the Miocene and the present-day ocean-sea geometry**.**
Important conclusions: Understanding of freshwater impacts in high latitudes on the ocean-atmosphere dynamics is important for understanding past and possible future climate change. Based on our results, we argue that relatively small and geologically short-lived changes in freshwater balance in the Southern Ocean could be responsible, at least partially, for two prominent disruptions (20 and 14 Ma) of the dynamic Miocene's general cooling trend. Finally, we also argue that the widely accepted bi-polar scheme of the ocean circulation changes may need to be revisited and updated.
Significance for management: Our results, coupled with other scientific findings, indicate that freshwater impacts in the southern hemisphere might have been one of the key causations of strong climate swings in the Miocene Epoch. Although the study addresses a paleoclimate issue, main results are applicable to understanding of possible climate trends that may be caused by southern cryosphere melting of re-freezing. These results are of significant interest to a broader scientific community and especially to oceanographers and climatologists who are analyzing or forecasting ocean change caused by ongoing or possible future global temperature and salinity variability and trends. This

study indicates that relatively small salinity changes in the southern high latitudes may be critical for the climate system dynamics.
Degree of controversy: Moderate-to-high degree of controversy. There are still many climate scientists who believe that CO2 impacts are the only important climate drivers. Our study adds up to the opinion that freshwater impacts may be also critical for the climate system variability. Moreover, it suggests that the widely-accepted oceanic seesaw paradigm needs to be revised and updated for paleoclimate modeling to include a strong geometry control. Finally, it indicates that salinity data are extremely important, especially in the high latitudes for monitoring and predicting present and possible future ocean-atmosphere long-term variability.

3. OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

3a. **Title of paper:** *Line-transect Abundance Estimates of False Killer Whales* (Pseudorca crassidens) *in the Pelagic Region of the Hawaiian Exclusive Economic Zone and in the Insular Waters of the Northwestern Hawaiian Islands*
Journal: PIFSC Administrative Report H-12-02 (a document disseminated on the PIFSC website)
Expected publication date: June 1, 2012
Authors: Amanda L. Bradford, University of Hawaii Joint Institute for Marine and Atmospheric Research; **Karin A. Forney**, NMFS Southwest Fisheries Science Center; **Erin M. Oleson**, NMFS Pacific Islands Fisheries Science Center; **Jay Barlow**, NMFS Southwest Fisheries Science Center
Abstract from paper: Three stocks of false killer whales (*Pseudorca crassidens*) can be differentiated within the U.S. Exclusive Economic Zone of the Hawaiian Islands (Hawaiian EEZ): an insular main Hawaiian Islands stock, a dispersed pelagic stock, and a newly recognized Northwestern Hawaiian Islands stock. Current abundance estimates are needed for the pelagic and Northwestern Hawaiian Islands stocks. To this end, a ship-based line-transect survey of the Hawaiian EEZ was conducted in the summer–fall of 2010, resulting in 6 systematic-effort visual sightings of pelagic (n = 5) and Northwestern Hawaiian Islands (n = 1) false killer whale groups. These sightings were combined with data from multiple sources and analyzed within the conventional line-transect estimation framework, although the detection function, mean cluster size, and encounter rate were estimated separately so as to appropriately incorporate data collected using different methods. Unlike previous line-transect analyses of false killer whales, subgroups were treated as the analytical unit instead of groups because subgroups better conform to the specifications of line-transect theory. Bootstrap values (n = 5000) of the line-transect parameters were randomly combined to estimate the variance of stock-specific abundance estimates. Hawaii

pelagic and Northwestern Hawaiian Islands false killer whales were estimated to number 1503 (CV = 0.66) and 552 (CV = 1.09) individuals, respectively. These estimates can be considered positively biased to an unknown extent due to the effect of vessel attraction.

Significance for management: These findings may inform assessments of pelagic false killer whales occurring in the EEZ of the Hawaiian Islands that are prepared by the Pacific Scientific Review Group (SRG); Stock Assessment Reports (SAR) of the SRG provide advice to NMFS on stock status and potential biological removals. Stock status results are of particular interest because previous SAR reports showed that the bycatch of pelagic false killer whales in the Hawaiian Islands EEZ exceeded allowable levels. In July 2011, NMFS published a Proposed False Killer Take Reduction Plan for reducing false killer whale bycatch in the Hawaii longline fishery.

3b. Title: *Synthesis of Marine Ecosystem Monitoring Activities for the United States Virgin Islands*

Journal: NOAA Technical Memorandum NOS NCCOS 148. Silver Spring, MD. 55 pp.

Authors: S.J., S. Hitt, G.F. Renchen, C.F.G. Jeffrey

Abstract: This report provides a synthesis of marine monitoring activities that have taken place in the nearshore waters of the U.S. Virgin Islands in the past two decades between 1990 and the end of 2009. Summary metadata are provided that describe the monitoring programs, their implementing agency, the ecosystem components that are measured together with maps showing where the measurements were taken. This information is intended to facilitate data sharing and synergies between monitoring programs, inform and enhance strategic planning for regional and national monitoring, avoid duplication of effort and increase knowledge and awareness of the spatial, temporal and compositional characteristics of monitoring in the U.S. Virgin Islands.

Important conclusions: A wide range of parameters are measured across all surveillance and monitoring projects, with very little duplication of efforts. However, most of the territorially managed areas such as the Areas of Particular Concern (APCs) in St. Thomas were largely un-surveyed or monitored. A substantial gap existed for seagrass monitoring in the USVI. Although nearshore waters are measured with regard to human health issues, no targeted monitoring with exceedence thresholds existed for monitoring coral reef ecosystem health. Sediment monitoring was localized to specific areas to compare impacted versus less impacted watersheds, rather than being a region wide systematic monitoring program. Few studies have systematically quantified human uses of the marine environment across space and over time. Newly emerging concerns based on predicted environmental changes, including some new threats to ecosystems, are not well covered in the 1990 to 2009 activities. Targeted monitoring of species recovery is also rarely stated as an objective and few projects focus on individual keystone species such as spiny sea urchins. Permanent long-term monitoring sites that have been surveyed regularly for longer than a decade are rare.

Significance: We hope that this document is a useful look up guide to help resource managers and researchers identify, share and integrate data sets in novel and useful ways and guide strategic decision making in future monitoring efforts.